Testimony of Dr. Raymond L. Orbach
Director, Office of Science
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Introduction

Mr. Chairman, Members of the Committee, it is a pleasure to join you today to present the Department of Energy's FY 2005 budget submission and to focus on the details that fall under the purview of this Committee. The Department appreciates the support of the Chairman and the Members of the Committee over the past years and I look forward to working with you to ensure that our Nation stays at the leading edge of science and technology in the 21st Century. I am testifying on behalf of Mr. Robert Card, Under Secretary for Energy, Science and the Environment at the Department of Energy.

The Department of Energy in the last three years has been guided by the Administration's commitment to better management in government and the importance of scientific discovery. Our cadre of scientists and engineers from all disciplines create and inspire dynamic discoveries that change our way of life. To complement our support for scientific discovery, the Department has fully embraced the President's Management Agenda – emphasizing performance, aligning resources directly to mission priorities, and integrating these objectives into the management of human capital. This synergy has sharpened the focus of the Department of Energy and, I believe, will result in dramatic achievements of real importance to the everyday lives of Americans.

Setting Priorities - Three years ago, Secretary Abraham defined the Department's primary mission to support national security and established a series of programmatic objectives in national security, energy, environmental quality, science, and corporate management. From this mission and departmental objectives, the Department's Strategic Plan was developed, setting in place a long-range programmatic vision. To orient the Department to results and performance, the long-range planning goals and targets have been articulated into shorter-term performance goals, objectives, and metrics that are reflected throughout the FY 2005 detailed budget justifications.

The FY 2005 budget request of $24.3 billion is formulated to meet four broad programmatic goals and objectives in corporate management:

- **Defense -** *To protect our national security by applying advanced science and nuclear technology to the Nation's defense.* The FY 2005 budget proposes $9.0 billion to meet defense-related objectives. The budget request maintains commitments to the nuclear deterrence requirements of the Administration's Nuclear Posture Review and continues to fund a strong strategy to mitigate the threat of weapons of mass destruction.
- **Energy -** *To protect our national and economic security by promoting a diverse supply and the delivery of reliable, affordable, and environmentally sound energy.* The FY 2005 budget requests $2.7 billion to meet energy-related objectives. The budget request maintains Presidential objectives to promote energy security and reliability through increases in coal research and development, hydrogen

production and fuel cell powered vehicles, advanced nuclear energy technologies, and electric transmission reliability.

- **Science -** *To protect our national and economic security by providing a world-class scientific research capacity and advancing scientific knowledge*. The FY 2005 budget seeks $3.4 billion to meet science-related objectives. The budget request continues the Administration's commitment to the Nation's scientific strength by maintaining essential facility and national laboratory operations, and support for research in the exciting fields of fusion, advanced scientific computing, nanoscience, microbial genomics, high energy and nuclear physics and the research tools that enable forefront scientific research.
- **Environment -** *To protect the environment by providing a responsible resolution to the environmental legacy of the Cold War and by providing for the permanent disposal of the Nation's high level radioactive waste*. The FY 2005 budget requests $8.4 billion to meet environmental-related objectives. The budget request includes significant increases to fulfill commitments to accelerate environmental cleanup, maintain the schedule to establish a permanent geologic nuclear waste repository by 2010, and accelerate assistance to employees of the Cold War nuclear weapons complex who may have been harmed by their work.

All of the programs and activities highlighted in this Budget depend heavily upon advanced research and development and could not be achieved were it not for the world-leading scientific and engineering capabilities available in the Department's national laboratories and at universities across the Nation.

I am proud to tell you that the Department of Energy was ranked the most improved cabinet-level agency in the most recent scorecard to assess implementation of the President's Management Agenda (PMA). The scorecard, which evaluates agency performance in the areas of human capital, competitive sourcing, financial management, e-government, and budget/performance integration, was issued by OMB in January and recognized the Department as one of the agencies "leading the pack with regard to management improvement."

Let me now review the program areas under this Committee in greater detail.

The Office of Science

Overview. The Office of Science FY 2005 budget request is $3.432 billion, a $68,451,000 decrease over the FY 2004 appropriation levels. When $140,762,000 for FY 2004 Congressionally-directed projects is set aside, there is an increase of $72,311,000 in FY 2005. When compared to the FY 2004 comparable President's Request, the FY 2005 request increases $104,885,000 or 3.2 percent. This request allows us to increase support for high priority scientific research, increase operations at our key scientific user facilities, keep existing construction projects on schedule, and support new initiatives. This request, coming at a time of tight overall Federal budgets, is also a demonstration of the Administration's support for basic research and the role that fundamental science plays in keeping our Nation strong and secure.

When I joined the Office of Science after a career as a university scientist and administrator, I came with an appreciation for the four key roles that the Office plays in the U.S. research effort: *We provide solutions to our Nation's energy challenges*, contributing essential scientific foundations to the energy, national, and economic security missions of the U.S. Department of Energy (DOE). *We are the Nation's leading supporter of the physical sciences*, investing in research at over 280 universities, 15 national laboratories, and many international research institutions. *We deliver the premier tools of science to our Nation's science enterprise*, building and operating major research facilities for open access by the science community. *We keep the U.S. at the forefront of intellectual leadership*, supporting the core capabilities, theories, experiments, and simulations to advance science.

This FY 2005 budget request will set us on the path toward addressing the challenges that face our Nation in the 21st Century. The Office of Science has recently released *Facilities for the Future of Science: A Twenty-Year Outlook* which sets an ambitious agenda for scientific discovery over the next two decades. The priorities established in this plan—which is not a budget document—reflect national priorities set by the President and the Congress, our commitment to the missions of the Department of Energy, and the views of the U.S. scientific community. Pursuing these priorities will be challenging, but they hold enormous promise for the overall well-being of all of our citizens. We will soon release an updated *Office of Science Strategic Plan* that is fully integrated with the Facilities Plan, the Department's new Strategic Plan, and the President's Management Agenda –

including the R&D Investment Criteria and OMB's Program Assessment Rating Tool. The FY 2005 budget request begins to implement these plans.

DOE's Office of Science leads the world in the conception, design, construction, and operation of these large-scale devices. These machines have enabled U.S. researchers to make some of the most important scientific discoveries of the past 70 years, with spin-off technological advances leading to entirely new industries. More than 19,000 researchers and their students from universities, other government agencies (including the National Science Foundation and the National Institutes of Health), private industry, and those from abroad use DOE facilities each year. These users are both growing in number and diversity.

We credit our outstanding track record in construction to a highly effective management and review process. We have been so successful that our process is now considered a "best practice" across the U.S. government by OMB and OSTP, and we are being consulted by CERN, Europe's premier particle physics laboratory, on construction of their Large Hadron Collider, a facility to which the United States (through a partnership between the Office of Science and the National Science Foundation) is contributing $531 million.

Because of the extraordinarily wide range of scientific disciplines required to support facility users at national laboratories, and the diversity of mission-driven research supported by the Office of Science, we have developed an interdisciplinary capability

that is extremely valuable to some of the most important scientific initiatives of the 21st Century. There is also a symbiotic relationship between research and research tools. Research efforts advance the capabilities of the facilities and tools that in turn enable new avenues of research.

The Office of Science funds research at DOE's national laboratories and at 280 colleges and universities located across the country. Excluding funds used to construct or operate our facilities, approximately half of our base research funding goes to support research at universities and institutes. Academic scientists and their students are funded through peer-reviewed grants, and SC's funding of university research has made it an important source of support for graduate students and postdoctoral researchers in the physical sciences during their early careers.

Office of Science research programs are managed in seven major areas, including an enhanced effort in Workforce Development for Teachers and Scientists.

Advanced Scientific Computing Research (ASCR). ASCR significantly advances scientific simulation and computation, applying new approaches, algorithms, and software and hardware combinations to address the critical science challenges of the future, and provides access to world-class, scientific computation and networking facilities to the Nation's scientific community to support advancements in practically every field of science and industry. The ASCR budget also supports the *Scientific Discovery through Advanced Computing (SciDAC)* program — a set of coordinated

investments across all Office of Science mission areas with the goal of achieving breakthrough scientific advances via computer simulation that were impossible using theoretical or laboratory studies alone.

The FY 2005 budget includes $204 million for ASCR to advance U.S. leadership in high performance supercomputing, networking and software development to continue to advance the transformation of scientific simulation and computation into the third pillar of scientific discovery. The request includes $38 million for the *Next Generation Computer Architecture (NGA)* to acquire additional advanced computing capability for existing users, and for longer-term research and development on new architectures for scientific computers. Enhancements are supported for ASCR facilities – the Energy Sciences Network (ESnet) and the National Energy Research Scientific Computing Center (NERSC). The request also includes $8.5 million for the new *Atomic to Macroscopic Mathematics* research effort to provide the research support in applied mathematics needed to break through the current barriers in our understanding of complex physical processes.

Basic Energy Sciences (BES). The BES program is a principal sponsor of fundamental research for the Nation in the areas of materials sciences and engineering, chemistry, geosciences, and bioscience as it relates to energy. This research underpins the DOE missions in energy, environment, and national security; advances energy-related basic science on a broad front; and provides unique user facilities for the scientific community and industry.

For FY 2005, the Department requests $1,064 million for BES including $209 million to continue to advance nanoscale science through atomic- and molecular-level studies in materials sciences and engineering, chemistry, geosciences, and energy biosciences. This supports Project Engineering Design (PED) and construction on four Nanoscale Science Research Centers (NSRCs) and a Major Item of Equipment for the fifth and final NSRC. NSRCs are user facilities for the synthesis, processing, fabrication, and analysis of materials at the nanoscale. The request also includes $80.5 million for construction and $33.1 million for operation of the Spallation Neutron Source and $50 million for design and long lead procurement of the Linac Coherent Light Source, a revolutionary x-ray laser light source. With these tools, we will be able to understand how the compositions of materials affect their properties, watch proteins fold, see chemical reactions, and design matter for desired outcomes.

The FY 2005 budget request also includes $29 million for activities that support the President's Hydrogen Fuel Initiative. This research program is based on the BES workshop report *"Basic Research Needs for the Hydrogen Economy",* which highlights the enormous gap between our present capabilities and those required for a competitive hydrogen economy.

Biological and Environmental Research (BER). BER advances energy-related biological and environmental research in genomics and our understanding of complete biological systems, such as microbes that produce hydrogen; in climate change, including

the development of models to predict climate over decades to centuries; developing science-based methods for cleaning up environmental contaminants; in radiation biology, providing regulators with a stronger scientific basis for developing future radiation protection standards; and in the medical sciences, by developing new diagnostic and therapeutic tools, technology for disease diagnosis and treatment, non-invasive medical imaging, and biomedical engineering such as an artificial retina that will restore sight to the blind. For FY 2005, the Department requests $502 million for BER which does not provide continued support for the $141 million in Congressional earmarks from FY 2004.

Research on microbes through the *Genomics: GTL* program, addressing DOE energy and environmental needs, continues to expand from $63.4 million in FY 2004 to $67.5 million in FY 2005. The request also supports initiation of Project Engineering Design (PED) activities for the GTL Facility for the Production and Characterization of Protein and Molecular Tags, a facility that will help move the excitement of the *Genomics: GTL* systems biology research program to a new level by greatly increasing the rate and cost-effectiveness with which experiments can be done. DOE, through the *Genomics: GTL* program, will attempt to use genetic techniques to harness microbes to consume pollution, create hydrogen, and absorb carbon dioxide.

Fusion Energy Sciences (FES). The FES program advances the theoretical and experimental understanding of plasma and fusion science, including a close collaboration with international partners in identifying and exploring plasma and fusion physics issues through specialized facilities. This includes: 1) exploring basic issues in plasma science;

2) developing the scientific basis and computational tools to predict the behavior of magnetically confined plasmas; 3) using the advances in tokomak research to enable the initiation of the burning plasma physics phase of the Fusion Energy Sciences program; 4) exploring innovative confinement options that offer the potential of more attractive fusion energy sources in the long term; 5) focusing on the scientific issues of nonneutral plasma physics and High Energy Density Physics; 6) developing the cutting edge technologies that enable fusion facilities to achieve their scientific goals; and 7) advancing the science base for innovative materials to establish the economic feasibility and environmental quality of fusion energy.

When the President announced that the U.S. would join in the International Thermonuclear Experimental Reactor (ITER) project he noted that "the results of ITER will advance the effort to produce clean, safe, renewable, and commercially available fusion energy by the middle of this century." To this end, the Department continues its commitment to the future of Fusion Energy Science research with a request of $264.1 million, slightly above the FY 2004 level. Within that amount, DOE's funding in preparation for ITER in FY 2005 is $38 million, $30 million more than last year. Of this $38 million, $7 million is for engineers who support the International Team and for the qualification of vendors for superconducting cable. The other $31 million is for experiments on our tokamak facilities and for component R&D in our laboratories and universities that is closely related to our ongoing program but which is focused on ITER's specific needs.

Fabrication of the National Compact Stellarator Experiment (NCSX) will continue with a target of FY 2008 for the initial operation of this innovative new confinement system that is the product of advances in physics understanding and computer modeling. In addition, work will be initiated on the *Fusion Simulation Project* to provide an integrated simulation and modeling capability for magnetic fusion energy confinement systems over a 15-year development period. The Inertial Fusion Energy research program will be redirected toward high energy density physics research based on recommendations of the recently established Interagency Task Force on High Energy Density Physics.

High Energy Physics (HEP). HEP advances understanding of dark energy and dark matter, the striking imbalance of matter and antimatter in the current universe, the basic constituents of matter, and the possible existence of other dimensions, collectively revealing the key secrets of the birth, evolution, and final destiny of the universe. HEP expands the energy frontier with particle accelerators to study fundamental interactions at the highest possible energies, which may reveal the rest of the universe: new particles, new forces or undiscovered dimensions of space and time; explain how everything came to have mass; and illuminate the pathway to the underlying simplicity of the universe.

For FY 2005, the Department requests $737 million for the HEP program, about the same as in FY 2004. Highest priority in HEP is the operations, upgrades and infrastructure for the two major HEP user facilities at the Fermi National Accelerator Laboratory (Fermilab) and the Stanford Linear Accelerator Center (SLAC), to maximize the scientific data generated.

In 2005, the Neutrinos at the Main Injector (NuMI) facility will be complete and the beam line will be commissioned. The FY 2005 budget request also supports engineering design activities for a new Major Item of Equipment, the BTeV ("B Physics at the TeVatron") experiment at Fermilab to extend current investigations that uses modern detector technology to increase our data rate by more than two orders of magnitude. Research, development and design funding continues in FY 2005 on the proposed Supernova Acceleration Probe (SNAP) experiment for the DOE/NASA Joint Dark Energy Mission (JDEM).

Nuclear Physics (NP). NP supports innovative, peer reviewed scientific research to advance knowledge and provide insights into the nature of energy and matter, and in particular, to investigate the fundamental forces which hold the nucleus together, and determine the detailed structure and behavior of the atomic nuclei. Nuclear science plays a vital role in studies of astrophysical phenomena and conditions of the early universe. At stake is a fundamental grasp of how the universe has evolved, an understanding of the origin of the elements, and the mechanisms of supernovae core collapse. The program builds and supports world-leading scientific facilities and state-of-the-art instruments necessary to carry out its basic research agenda. Scientific discoveries at the frontiers of Nuclear Physics further the nation's energy-related research capacity, which in turn provides for the nation's security, economic growth and opportunities, and improved quality of life.

The FY 2005 budget request of $401 million gives highest priority to exploiting the unique discovery potentials of the facilities at the RHIC and Continuous Electron Beam Accelerator Facility (CEBAF) by increasing operating time by 26% compared with FY 2004. R&D funding is provided for the proposed Rare Isotope Accelerator (RIA) and 12 GeV upgrade of CEBAF at Thomas Jefferson National Accelerator Facility.

Operations of the MIT/Bates facility will be terminated as planned, following three months of operations in FY 2005 to complete its research program. This facility closure follows the transitioning of operations of the Lawrence Berkeley National Laboratory 88-Inch Cyclotron in FY 2004 from a user facility to a dedicated facility for the testing of electronic circuit components for use in space (using funds from other agencies) and a small in-house research program. These resources have been redirected to better utilize and increase science productivity of the remaining user facilities and provide for new opportunities in the low-energy subprogram.

Workforce Development for Teachers and Scientists. The mission of the Workforce Development for Teachers and Scientists program is to continue the Office of Science's long-standing role of training young scientists, engineers, and technicians in the scientifically and technically advanced environments of our National Laboratories.

The FY 2005 budget request of $7.66 million provides $1.5 million for a *Laboratory Science Teacher Professional Development* activity. About 90 participating teachers will gain experience and enhance their skills at five or more DOE laboratories in response to

the national need for science teachers who have strong content knowledge in the classes they teach. A new $0.5 million *Faculty Sabbatical Fellowship* activity will provide sabbatical opportunities for 12 faculty from minority serving institutions (MSIs). This proposed activity is an extension of the successful *Faculty and Student Teams* (FaST) program where teams of faculty members and two or three undergraduate students, from colleges and universities with limited prior research capabilities, work with mentor scientists at a National Laboratory to complete a research project that is formally documented in a paper or presentation.

The Office Energy Efficiency and Renewable Energy

Research, development and deployment of advanced clean energy technologies are making a difference in everyday lives of Americans today and will make an even larger difference tomorrow. Advanced energy efficient technologies and practices that use less energy, as well as renewable energy technologies that produce power and heat more cleanly than conventional sources, are well on their way to becoming today's answers to tomorrow's energy and environmental challenges.

The Department allocates more funding for energy efficiency and renewable energy than it does for any other energy activity. The Fiscal Year 2005 Budget Request for the Office of Energy Efficiency and Renewable Energy (EERE) is $1.25 billion, a $15.3 million increase over the Fiscal Year 2004 comparable funding level. This budget builds on successes already achieved and delivers on promises and commitments made in past budget requests.

The Department's Fiscal Year 2005 budget request continues to implement the priorities established in the National Energy Policy Report and the Department of Energy Strategic Plan, and reflects priorities set in the EERE Strategic Program Review. EERE also used the research and development investment criteria called for in the President's Management Agenda to evaluate its portfolio and focus its research and development dollars on long-term, potentially high payoff activities that require Federal involvement to be successful and achieve public benefit.

The Fiscal Year 2005 budget reflects Secretary Abraham's challenge to EERE that it take a bold approach to EERE-sponsored work. Recognizing increasing dependence on energy from areas of the world that can be unstable, and recognizing that questions surrounding climate change can increase the focus on reducing greenhouse gas emissions, the Secretary directed that the program take a revolutionary, rather than an evolutionary approach to meeting National Energy Policy Report's goals of increased energy security, greater freedom for Americans in their energy choices, and reduced costs and environmental impacts associated with those choices.

One such revolutionary approach is embodied in the President's *FreedomCAR Partnership and Hydrogen Fuel Initiative,* the goal of which is an industry decision by 2015 to commercialize hydrogen-powered fuel cell vehicles. To the extent that hydrogen is produced from domestic resources in an environmentally sound manner, hydrogen fuel cell vehicles will require no petroleum-based fuels and emit no criteria pollutants or

carbon dioxide, and their commercial success would essentially remove personal transportation as an environmental issue and substantially reduce our dependence on foreign oil. The *FreedomCAR Partnership and Hydrogen Fuel Initiative* now include both auto manufacturers and energy companies, helping to ensure that hydrogen will be available and affordably priced when fuel cell vehicles are ready for commercialization. Over the past year significant R&D advances have increased confidence that the 2015 goal is realistic and attainable. Together with programs in Fossil Energy, Nuclear Energy and Science, the Department's Fiscal Year 2005 commitment to the *Hydrogen Fuel Initiative* is $227 million.

The Fiscal Year 2005 budget requests $10.2 million to continue our Solid State Lighting program begun last year. Solid State Lighting represents a revolutionary approach to lighting our homes and businesses that has the potential to more than double the efficiency of general lighting systems in the coming decades, conserving enough electricity nationally to power the states of Arizona, Colorado, and Mississippi. Advancing the technology and lowering the cost of organic and inorganic light emitting diodes will lead to more efficient, flexible and functional lighting technology in the future. The budget for Solid State Lighting keeps the Department on track to overcome technical barriers to everyday use of these innovative technologies.

In the deployment area, the Fiscal Year 2005 budget request maintains the President's commitment to increase funding for the Weatherization Assistance Program by $1.4 billion over ten years to help low-income Americans who spend a disproportionately high

share of their income on energy. This year's budget request will allow the weatherization of nearly 119,000 low-income homes, saving $1.30 in energy costs for every dollar invested.

Federal Energy Management Program (FEMP) alternative financing programs and technical assistance helps Federal agencies access private sector financing to fund energy improvements through Energy Savings Performance Contracts and Utility Energy Service Contracts at no net cost to taxpayers. In addition, FEMP promotes a whole-building design strategy and provides awards to groups within Federal agencies that achieve excellence in energy management. The Fiscal Year 2005 request is $17.9 million for FEMP to continue reducing Federal energy consumption. As FEMP's core activities have evolved, efficiencies have increased, enabling a reduced funding level in Fiscal Year 2005.

The Office of Electric Transmission and Distribution

The mission of the newly created Office of Electric Transmission and Distribution (OETD) is to lead a national effort to modernize and expand America's electricity delivery system to ensure a more reliable and robust electricity supply, as well as economic and national security. This is vital to the Department's strategic goal: to protect our national and economic security by promoting a diverse supply and delivery of reliable, affordable, and environmentally sound energy.

The August 14, 2003 blackout demonstrated the electric grid's strategic importance to our Nation. President George Bush stated in September 2003: "…it's clear that the power grid needs an overhaul. It needs to be modernized. As we go into an exciting new period of American history, we want the most modern electricity grid for our people… we need more investment; we need research and development…"

OETD requests $90.9 million for FY 2005 to increase reliability, which reflects a 12.4 percent increase over the FY 2004 comparable appropriation. This effort includes research, development, demonstration, technology transfer, and education and outreach activities in partnership with industry, businesses, utilities, States, other Federal programs and agencies, universities, national laboratories, and other stakeholders.

Neither government nor industry alone can satisfy the Nation's electric infrastructure needs. The *National Delivery Technologies Roadmap* provides a framework for all of the electric industry stakeholders to work together to achieve common aims. The call for grid modernization is coming from all levels of leadership. The President's 2004 State of the Union request to Congress to "modernize our electricity system" reiterated the Administration's objectives first outlined in the *National Energy Policy [May 2001]* and then reinforced, in more detail, in the *National Transmission Grid Study (NTGS) [May 2002]*.

Modernizing the grid will involve time, resources, and unprecedented levels of cooperation. The Nation's aging electric infrastructure — and the increasing

requirements placed on it — have contributed to market inefficiencies and electricity congestion in several regions. These conditions could lead to more outages, more power quality disturbances, higher prices, and the less efficient use of resources. We must act now or risk even greater problems in the future.

The GridWise and GridWorks Initiatives. OETD's FY 2005 Budget request — reflecting the Administration's efforts to modernize and expand the electric grid — includes $10.5 million for the new GridWorks Initiative and the existing GridWise Initiative, which are aimed at reducing the likelihood and impact of reliability events, such as blackouts.

GridWise denotes a modernized electric infrastructure framework where open, but secure, communication and information technologies, and associated standards, are used throughout the electric grid to enhance reliability and robustness, promote economic efficiencies, and provide value and choices to electricity consumers. The GridWise program activity (software-centric) comprises the intelligence – or brains – behind a modern electric grid that incorporates GridWorks (hardware-centric) technology.

GridWorks is focused on advanced equipment applications, taking an integrated approach to the entire electric system. It bridges the gap between the laboratory prototypes of the base programs and the application needs of the electric industry. GridWorks uses the facilities at DOE's National Laboratories to accelerate the development and testing of advanced conductors, which can increase much-needed transmission line capacity. It

complements GridWise's architectural software development by developing and demonstrating associated hardware, such as sensors. GridWorks pursues advanced power electronic breakthroughs to provide faster means of limiting transmission problems before they propagate through the electric system.

High Temperature Superconductivity. OETD's FY 2005 Budget request includes a $10.9 million increase for High Temperature Superconductivity R&D to develop second generation wire usable in cables, generators, transformers, and motors – equipment that crosscuts the entire electric power value chain.

High temperature superconductors are a good example of advanced materials that have the potential to revolutionize electric power delivery in America. The prospect of transmitting large amounts of power through compact underground corridors, with minimal electrical losses and voltage drop over long distances, could significantly enhance the overall energy efficiency and reliability of the electric system, while reducing fuel use, air emissions, and any physical footprint. Also, breakthroughs in basic science are rapidly applied in the area of high temperature superconductivity. For instance, benefits from nanoscience research are accelerating progress in superconductivity wire development.

The Office of Fossil Energy

Fossil Energy's programs focus on supporting the President's top initiatives for energy security, clean air, climate change, and coal research. FY 2005 Fossil Energy programs:

- Support the development of lower cost, more effective pollution control technologies embodied in the President's Coal Research Initiative or help diversify the nation's future sources of clean-burning natural gas to meet the goals of President's Clear Skies initiative;
- Expand the nation's technological options for reducing greenhouse gases either by increasing power plant efficiencies or by capturing and isolating these gases from the atmosphere as called for by the President's Global Climate Initiative;
- Or measurably add to the nation's energy security by providing a short-term emergency response, such as the Strategic Petroleum Reserve, or a longer-term alternative to imported oil, such as hydrogen and methane hydrates.

The President's Coal Research Initiative. Fossil Energy's FY 2005 Budget continues to meet the President's clean coal commitment by providing $447 million for the Coal Research Initiative, an increase of 40 percent or $126.5 million over last year's request.

Under President Bush's leadership, budget requests for coal R&D have more than doubled over historical amounts and appropriations.

Clean Coal Power Initiative and FutureGen. The **Clean Coal Power Initiative** (CCPI) is a key component of the National Energy Policy to address the reliability and affordability of the Nation's electricity supply, particularly from its coal-based generation. The FY 2005 Budget includes $287 million for CCPI, of which $237 million is for FutureGen, the world's first zero-emissions hydrogen and electicity producing

power plant. FutureGen will establish the capability and feasibility of co-producing electricity and hydrogen from coal with essentially zero emissions, including carbon sequestration and gasification combined cycle, both integral components of the zero emissions plant of the future.

The CCPI is a cooperative, cost-shared program between the government and industry to rapidly demonstrate emerging technologies in coal-based power generation and to accelerate their commercialization. The Nation's power generators, equipment manufacturers, and coal producers help identify the most critical barriers to coal's use in the power sector. Technologies are selected with the goal of accelerating development and deployment of coal technologies that will economically meet environmental standards, while increasing the efficiency and reliability of coal power plants.

CCPI is especially significant because it directly supports the President's Clear Skies initiative. The first projects included an array of new cleaner and cheaper concepts for reducing sulfur dioxide, nitrogen oxides, and mercury – the three air pollutants targeted by the Clear Skies initiative.

Since last year, the Department has made significant progress on a new generation of environmentally-clean coal technologies.

The "first round" in the Clean Coal Power Initiative – the centerpiece of the President's clean coal commitment – attracted three dozen proposals for projects totaling more than

$5 billion. In early 2003, we announced the first winners of the competition – eight projects with a total value of more than $1.3 billion, more than one billion dollars of which would be provided by the private sector. These projects are expected to help pioneer a new generation of innovative power plant technologies that could help meet the President's Clear Skies and climate change objectives.

Competitive solicitations for the "second round" will be made in early 2004 and are open to technologies capable of producing any combination of heat, fuels, chemicals, or other useful by-products in conjunction with electricity generation.

FutureGen. In order to assure that FutureGen is successful, it will be supported in FY05 by a clean coal R&D effort at a proposed level of $46.5 million. It will be focused on all the key technologies needed - such as carbon sequestration, membrane technologies for oxygen and hydrogen separation, advanced turbines, fuel cells, coal to hydrogen conversion, gasifier related technologies, and other technologies.

Carbon Management. Several Clean Coal projects also help expand the menu of options for meeting the President's climate change goal of an 18 percent reduction in greenhouse gas intensity (carbon equivalent per GDP) by 2012, primarily by boosting the efficiencies of power plants (meaning that less fuel is needed to generate electricity with a corresponding reduction in greenhouse gases).

Carbon management has become an increasingly important element of our coal research program. Carbon sequestration – the capture and permanent storage of carbon dioxide – has emerged as one of our highest priorities in the Fossil Energy research program – a priority reflected in the proposed budget of $49 million in FY 2005.

Continuing in FY 2005, one of the cornerstones of our carbon sequestration program will be a national network of regional partnerships. This Secretarial initiative, which I announced last year, will bring together the federal government, state agencies, universities, and private industry to begin determining which options for capturing and storing greenhouse gases are most practicable for specific areas of the country.

Funding from the Fossil Energy program will be combined with funding from the Office of Nuclear Energy and the Office of Energy Efficiency and Renewable Energy to competitively fund technology R&D with the greatest potential to reduce, avoid, or sequester gas emissions.

Hydrogen. Another aspect of the President's Clean Coal Research Initiative is the production of clean fuels from coal. Hydrogen has emerged as a major priority within the Administration and the Department of Energy as a clean fuel for tomorrow's advanced power technologies (such as fuel cells) and for future transportation systems. Within the Fossil Energy program, we have allocated $16 million for research into new methods for making hydrogen from coal.

Advanced Research. To provide fundamental scientific knowledge that benefits all of our coal technology efforts, our FY 2005 Budget includes $30.5 million for advanced research in such areas as materials, coal utilization science, analytical efforts, and support for coal research at universities (including historically black and other minority institutions).

Other Power Systems Research and Development. We are also proposing $23 million for continued development of fuel cells with an emphasis on lower-cost technologies that can contribute to both Clear Skies emission reductions, particularly in distributed generation applications, and Climate Change goals by providing an ultra-high efficiency electricity-generating component for tomorrow's power plants. Distributed power systems, such as fuel cells, also can contribute to the overall reliability of electricity supplies in the United States and help strengthen the security of our energy infrastructure.

Natural Gas Research. The President's Clear Skies Initiative also provides the rationale for much of the department's $26.0 million budget request for natural gas research. Even in the absence of new environmental requirements, natural gas use in the United States is likely to increase by 50 percent by 2020.

Our natural gas research program, therefore, is directed primarily at providing new tools and technologies that producers can use to diversify future supplies of gas. Emphasis will be increased on research that can improve access to onshore public lands, especially in the Rocky Mountain region where much of our undiscovered gas resource is located.

A particularly important aspect of this research will be to develop innovative ways to recover this resource while continuing to protect the environmental quality of these areas.

We also plan to establish a new industry-led, university consortia-based program to develop breakthrough technologies that can help assure a continued supply of affordable natural gas beyond 2015. The focus of this program will be on projects that could revolutionize the way natural gas is supplied in the United States – a focus that is well beyond the type of research industry is now doing.

Natural gas storage will also assume increasing significance in the United States as more and more power plants require consistent, year-round supplies of natural gas. Toward this end, we will initiate a nationwide, industry-led consortium that will examine ways to improve the reliability and efficiency of our nation's gas storage system and explore opportunities for LNG facility siting.

Over the long-term, the production of natural gas from hydrates could have major energy security implications. Hydrates are natural gas-bearing, ice-like formations in Alaska and offshore.

U.S. Geological Survey estimates indicate U.S. gas hydrates resources are larger by several orders of magnitude than previously thought and dwarf the estimated 1,400 trillion cubic feet of conventional recovered gas resources and reserves in the United States.

This huge resource warrants a new look at advanced technologies that might one day reliably and cost-effectively detect and produce natural gas from methane hydrates. Hydrate production, if it can be proved technically and economically feasible, has the potential to shift the world energy balance away from the Middle East. Understanding hydrates can also improve our knowledge of the science of greenhouse gases and possibly offer future mechanisms for sequestering carbon dioxide. For these reasons, we are continuing a research program to study gas hydrates with a proposed funding level of $6.0 million.

Oil Technology Development. The President's NEP calls attention to the continued need to strengthen our nation's energy security by promoting enhanced oil (and gas) recovery and improving oil (and gas) exploration technology through continued partnerships with public and private entities.

At the same time, however, we recognize that if the Federal oil technology R&D program is to produce beneficial results, it must be more tightly focused than in prior years. Consequently, our FY 2005 Budget request of $15.0 million reflects a reorientation of the program toward those areas where there is clearly a national benefit.

One example is the use of carbon dioxide (CO2) injection to enhance the recovery of oil from existing fields. CO2 injection is a proven enhanced oil recovery practice that prolongs the life of some mature fields, but the private sector has not applied this

technique to its fullest potential due to insufficient supplies of economical CO2. A key Federal role to be carried out in our proposed FY 2005 program will be to facilitate the greater use of this oil recovery process by integrating it with CO2 captured and delivered from fossil fuel power plants.

We will also refocus much of our Oil Technology program on a new Domestic Resource Conservation effort that will target partnerships with industry and universities to sustain access to marginal wells and reservoirs. These aging fields account for 40 percent of our domestic production and contain billions of barrels of oil that might still be recovered with ever-improving technology.

A high priority effort in FY 2005 will be to develop "micro-hole" technology. Rather than developing just another new drilling tool, the Federal program will integrate "smart" drilling systems, advanced imaging, and enhanced recovery technologies into a complete exploration and production system. Micro-hole systems may offer one of our best opportunities for keeping marginal fields active because the smaller-diameter wells can significantly reduce exploration costs and make new drilling between existing wells ("infill" drilling) more affordable.

Using breakthrough technology like this to keep marginal fields in production preserves the opportunity to eventually apply even more advanced innovations that could recover even larger quantities of domestic crude that traditional oil recovery methods currently leave behind.

Other Fossil Energy Activities. Our budget also includes $124.8 million for other activities in our Fossil Energy program, including $106.0 million for headquarters and field office salaries, $6.0 million for environmental restoration, $3.0 million for Federal matching funds for cooperative research and development projects at the University of North Dakota and the Western Research Institute, $1.8 million for natural gas import/export responsibilities, and $8 million for advanced metallurgical research at our Albany Research Center.

Petroleum Reserves. The Strategic Petroleum Reserve and Northeast Home Heating Oil Reserve are key elements of our Nation's energy security. Both serve as response tools for the President to use to protect U.S. citizens from disruptions in commercial energy supplies.

Strategic Petroleum Reserve. The President has directed us to fill the Strategic Petroleum Reserve to its full 700 million barrel capacity. The mechanism for doing this is a cooperative effort with the Minerals Management Service to exchange royalty oil from Federal leases in the Gulf of Mexico. We have been able to accelerate fill from an average of 60,000 barrels per day at the start of the President's initiative to a rate of 130,000 barrels per day.

Because of the President's "royalty in kind" initiative, we have achieved the Reserve's highest inventory level ever, now at 638 million barrels. Our goal remains to have a full inventory of 700 million barrels by the end of calendar 2005.

Our FY 2005 Budget for the SPR is $177.1 million, all of which is now in our facilities development and operations account. We do not require additional funds in the oil acquisition account because charges for transporting "royalty in kind" oil to the SPR are now the responsibility of the oil supplier. Also, because we have the authority to "borrow" funds from other Departmental accounts to support an emergency SPR drawdown, we no longer require the same amount of standby funding in this account.

Northeast Home Heating Oil Reserve. We are requesting $5.0 million for the Northeast Home Heating Oil Reserve, the same level as last year. The 2-million barrel reserve remains ready to respond to a Presidential order should there be a severe fuel oil supply disruption in the Northeast. A key element of this readiness is a new online computerized "auction" system that we implemented to expedite the bidding process. Installing and testing the electronic system (including tests with prospective commercial bidders) has been a major element of the Office of Fossil Energy's role in implementing the "e-government" initiatives in the President's management agenda.

Naval Petroleum and Oil Shale Reserves. The FY 2005 Budget request of $20.0 million funds continued operations. The Rocky Mountain Oilfield Testing Center (RMOTC), established at the Naval Petroleum Reserve No. 3 in Wyoming, will be

funded at $3 million. We also are working on proposals to transfer the Naval Petroleum Reserve No. 2 in California to the Department of the Interior by the end of FY 2005, although we anticipate that transition and certain environmental compliance activities will continue into FY 2005. We also expect to be able to reduce our funding requirements for equity redetermination studies for the Government's portion of the Elk Hills Naval Petroleum Reserve No. 1, which was divested in 1998. Of the four producing zones for which final equity shares had to be finalized, three have been completed; the fourth (the Shallow Oil Zone) is expected to be finished in FY 2005.

The Office of Nuclear Energy, Science and Technology

Overview. The FY 2005 budget proposal continues the Department's commitment to refining the benefits of nuclear power as a clean, reliable and affordable source of energy for this nation. The proposed $410 million investment in the Department's nuclear energy program includes funding to establish a new laboratory for nuclear energy research, development, demonstration and education; preconceptual design work for the Next Generation Nuclear Plant; continued work with utilities to pave the way for an industry order for a new nuclear power plant in the near future; and continued work with other countries to develop new reactor and fuel cycle technologies.

This budget request moves forward the Department's commitment to support the President's priorities to fortify U.S. energy independence and security while making significant improvements in environmental quality through the deployment of non-emitting generation capacity by the end of the decade. It also strengthens our nation's

nuclear education infrastructure, and recommends increased support for the Nuclear Hydrogen Initiative, which will take high temperature nuclear energy systems for clean hydrogen production from concept to reality. Finally, this request supports funds for the Advanced Fuel Cycle Initiative, which is aimed at developing proliferation-resistant fuel cycle technologies to reduce the volume and toxicity of commercial spent nuclear fuel and maximize energy from nuclear fuel.

Please allow me to explain in more detail how this budget proposal continues to advance the Department's nuclear energy initiatives.

Development of the Idaho National Laboratory – DOE's Nuclear Energy Research Center. This budget supports the Secretary's realignment of the mission at the current Idaho National Engineering and Environmental Laboratory to a focus on nuclear energy research and development. The Department is in the process of establishing the Idaho National Laboratory, which will combine the resources of the INEEL and the Argonne-West site. As the Department's leading center of nuclear research and development, a core mission of this laboratory is advanced nuclear reactor and fuel cycle technologies, including the development of space nuclear power and propulsion technologies. The new Idaho National Laboratory will play a vital role in the research and development of enabling technologies for the Next Generation Nuclear Plant, which will support the Department's long-term vision of a zero-emissions future free of reliance on imported energy.

The Department issued a Request for Proposals last week to find a management team to reduce costs and build expertise at the INL. The Department's nuclear energy program involves the collective talents of universities, the private sector, international partners and many of our other national laboratories – Argonne, Los Alamos, Sandia and Oak Ridge among them. The rebuilding of the Department's nuclear power research and development program, however, will be centered at INL. While environmental cleanup remains an important focus at the Idaho site, real progress is being made that will aid in the expansion of nuclear research and development. Within the 2005 budget, an additional $44 million is requested to manage laboratory infrastructure and security.

Generation IV Nuclear Energy Systems. The Generation IV program continues to support the Department's work to develop advanced reactor technologies for commercial deployment in the 2015 to 2030 timeframe. These advanced reactor concepts offer significant improvements in sustainability, proliferation resistance, physical protection, safety and economics. Generation IV nuclear energy systems will not only be safe, economic and secure, but also include energy conversion systems that produce valuable commodities such as hydrogen, desalinated water and process heat. These features make Generation IV reactors ideal for meeting the President's energy and environmental objectives.

The development of these reactors is being led by the Generation IV International Forum, a group of 10 leading nuclear nations (Argentina, Brazil, Canada, France, Japan, the Republic of Korea, the Republic of South Africa, Switzerland, the United Kingdom and

the United States), plus Euratom. The forum has selected six promising technologies for next-generation nuclear energy systems. While the Department is supporting research on several reactor concepts, this budget proposal places priority on the Next Generation Nuclear Plant (NGNP), a Very-High Temperature Reactor. This emphasis reflects the NGNP's potential for economically and safely producing electricity and hydrogen without emitting greenhouse gases. FY 2005 NGNP activities will be focused on research and development of fuels and structural materials for high-temperature, high-radiation environments, and continuing the concept design activities initiated in FY 2004. Research and development for the other Generation IV systems will focus on establishing technical and economic viability, and the resulting core and fuel designs and materials requirements.

Nuclear Hydrogen Initiatives. Hydrogen offers significant promise as a future energy technology, particularly for the transportation sector. The use of hydrogen in transportation will reduce U.S. dependence on foreign sources of petroleum, enhancing national security. Significant progress in hydrogen combustion engines and fuel cells is making transportation by hydrogen a reality. The goal of the Nuclear Hydrogen Initiative is to demonstrate the economic, commercial-scale production of hydrogen using nuclear energy. If successful, this research could lead to a large-scale, emission-free domestic hydrogen production capability to fuel a future hydrogen economy.

The Nuclear Hydrogen Initiative will focus primarily on hydrogen production technologies that utilize high-temperature nuclear reactors to produce hydrogen, which

then could supplant fossil fuels in our transportation system. With funding of $9 million in FY 2005, the Nuclear Hydrogen Initiative will move toward demonstrating nuclear-based hydrogen producing technologies in the laboratory, study potential hydrogen production schemes, and develop deployment alternatives to meet growing hydrogen demand.

As previously noted, the Generation IV program priority is on the Next Generation Nuclear Plant, which utilizes a Very-High-Temperature Reactor for advanced hydrogen production and electricity generation. Investigating and demonstrating the Generation IV nuclear energy systems will require advances in materials and systems technology, including development of high temperature and corrosion-resistant materials, and advanced chemical systems analysis. NE is working in close cooperation with the Department's Office of Science, through the Future Energy Advanced Materials Initiative, to evaluate common areas of research to develop advanced materials for use in nuclear hydrogen systems, as well as Generation IV Nuclear Energy Systems.

Advanced Fuel Cycle Initiative. Of all the challenges affecting the expansion of nuclear energy in the U.S. and worldwide, none is more important or more difficult than dealing effectively with spent nuclear fuel. After a long and difficult process, the country is moving forward with licensing a geologic repository for spent nuclear fuel. This is an absolute necessity, even as the Department develops advanced forms of spent nuclear fuel treatment. The Department plans to submit a license application for the repository to the Nuclear Regulatory Commission by the end of 2004.

Research on improving ways to treat and utilize materials from spent nuclear fuel will allow the Department to optimize the first repository, and delay – and perhaps even eliminate – the need for future repositories. The Advanced Fuel Cycle Initiative, with an investment of $46 million for FY 2005, will continue the progress made in the development of proliferation-resistant treatment and transmutation technologies that can reduce both the volume and toxicity of spent nuclear fuel. These technologies would support both national security and energy independence by reducing inventories of commercially-generated plutonium while recovering residual energy value from spent nuclear fuel.

The Department is proposing a research program leading to a demonstration of proliferation-resistant fuel treatment technology to reduce the volume of high-level waste, and development of advanced fuels that could allow the consumption of plutonium using existing light water reactors, or advanced gas reactors. Under the President's request, the Department will continue work toward demonstration of proliferation-resistant fuel treatment technology and continue design and testing of transmutation fuels for future use with current reactor technologies.

For the Advanced Fuel Cycle Initiative to be successful, advanced fuel treatment and transmutation research and development must be integrated with the development of Generation IV nuclear energy systems, particularly with those reactor technologies that can produce very high neutron levels that would be needed to transmute a wide variety of

toxic radioactive species. To support this goal, the Advanced Fuel Cycle Initiative will develop the advanced proliferation resistant fuels and fuel cycle systems for Generation IV reactors.

Nuclear Power 2010. The President's budget supports continuation of Nuclear Power 2010 in FY 2005 to demonstrate, in cost-shared cooperation with industry, key regulatory processes associated with licensing new nuclear plants in the U.S. The requested funds of $10 million would support the activities associated with achieving NRC approval of early site permits and development of Combined Construction and Operating License applications.

University Reactor Infrastructure and Education Initiative. For years, the Energy Department has sponsored an initiative that supports nuclear science and technology educational infrastructure through our University Reactor Infrastructure and Education Initiative. This program is essential to the continued operation of the nation's university research and training reactors, which play a vital role in supporting nuclear education and training.

The growth of nuclear energy in the United States is dependent on the preservation of the education and training infrastructure at universities. Research conducted using these reactors is critical to many national priorities. Currently there are 27 operating university research reactors at 26 campuses in 20 states. These reactors are providing support for research in such diverse areas as medical isotopes, human health, life sciences,

environmental protection, advanced materials, lasers, energy conversion and food irradiation.

Beyond technology and equipment, the DOE's university program supports the personnel required for a strong nuclear energy future. The demand for trained and qualified nuclear scientists currently exceeds supply. The President's budget includes $21 million for fellowships, scholarships, nuclear engineering research, and for critical support to university research reactors – all of which will help address this shortage of well-trained nuclear scientists.

Closing

Mr. Chairman, I believe the Department's FY 2005 budget submission meets the Nation's critical needs for energy, environmental and national security at a difficult time in our history. The Department of Energy, which Secretary Abraham has said might well be called the Department of Energy and Science, hopes to join the members of the Committee in working to strengthen American science and technology.